Title: Designing Our School Garden

Brief Overview:

This performance-based assessment integrates geometric problem solving with real-world application. Students will design a garden with a variety of flowers that each occupy a portion of the garden. Students will demonstrate their knowledge of area and perimeter, based on information gained from reading a table. They will also explain their decision-making process and math reasoning in letter form.

Link to Standards:

- **Problem Solving** Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers.

- **Communication** Students will demonstrate their ability to communicate mathmatically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Reasoning** Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Connections** Students will demonstrate their ability to connect mathematical topics within the discipline and with other disciplines.

- **Number and Number Relationships** Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose appropriate operations and describe effects of operations on numbers.

- **Measurement and Geometry** Students will demonstrate and apply concepts of measurement using non-standard and standard units of metric and customary units. They will apply measurement to interdisciplinary and real -world problem solving situations.

- **Statistics** Students will interpret information obtained from displays.

Grade/Level:

Grade 3

Duration/Length:

This lesson will take 3 days.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Perimeter and area
- Addition
- Multiplication
- Using information from a table
- Basic letter writing form

Objectives:

The students will be able to:

- read and interpret data.
- construct a rectangular region based on given dimensions.
- represent and determine the perimeter of the region by counting linear units.
- label the perimeter of the region.
- represent area by counting and shading square units.
- label the individual areas within the rectangular region.
- verify that the sum of the individual areas is equal to the total area which they occupy.
- write a letter explaining procedure used to solve the problem.

Materials/Resources/Printed Materials:

- Centimeter cubes
- Centimeter graph paper
- Ruler (or other straight edge)
- Flower table and task packet
- Crayons in a variety of colors

Performance Assessment - Development/Procedures

Day 1:

- As an introduction and review of perimeter and area, students will create rectangular regions with centimeter cubes. They will then count linear units to find perimeter, and square units to find area. Students will then draw their rectangular region on centimeter paper and label the perimeter and area. Students will share the colored regions that they drew and orally explain how they determined the area and perimeter of the regions.
- Hand out the performance task packet. Read the following vignette aloud as the students follow along in their packet:
    "The principal has decided to turn part of the playground into a garden. The third graders have been invited to design the garden, since you have been studying plants in Science. The principal has asked you to draw your garden plan on centimeter graph paper so that she can evaluate the plans in order to determine which design to use. When you complete your design you will write a letter to the principal explaining the steps that you have used to design your garden. You must also prove to her that your design follows all of the rules required to ensure proper growth and beauty for the flowers."
- The class will discuss what they know about gardens and some important factors to consider when planning one. The teacher will elicit the concept of space and area .

- Students will turn to Activity A and follow along as the teacher reads aloud:
  " The first thing that we must do is to make sure that the area set aside for the garden is protected. The principal needs to buy a rope to go around the entire perimeter of the garden.   The garden will be six feet wide and nine feet long. Using your centimeter graph paper, draw and label the perimeter of the garden. Notice that the key indicates that one centimeter is equal to one foot. Calculate how much rope the principal needs to buy in order to rope in the entire garden. Write a number sentence showing how you got your answer. Explain how you knew how much rope to buy."
- Students will work independently on Activity A.
- Students will use the Student Checklist for Activity A to check their own work.

Day 2:

- Reread the vignette and review the procedure that students used on Day One to set up the perimeter of their garden. Some students may be required to review their perimeter rubric again before moving on. However the concept assessed in Activity B (area) is not dependent on mastery of the concept assessed in Activity A (perimeter). Therefore students with gardens with incorrect dimensions may be allowed to move on .
- Go on to Activity B. Read it aloud as the students follow along:
  "Now you will plan which flowers to plant in the garden. In order to create a garden that looks beautiful and grows well, you must follow these rules in your planning:
  - You must use at least three different kinds of flowers.
  - You must include at least one sunflower in your garden.
  - All of the area in your garden must be used in your plan.
  - All sections must be labelled with the name of the flower and shaded in using a different color for each flower. You may use a key to indicate which color stands for each flower.
  - Be sure to follow all of the special needs listed in the table.
  Now you are ready to begin planning your garden. Remember that one centimeter is equal to one foot on your graph paper. Therefore one square centimeter is equal to one square foot on your graph paper."
- Students will now work on Activity B, which will include completing their garden and writing a number sentence or sentences to prove that the sum of the individual flower areas is equal to the total area of the garden. They will also write an explanation justifying their answer.

Day 3:

- Read the vignette for Activity C aloud as the students follow along:
  "Now that you have designed such beautiful gardens, we are ready to submit your designs to the principal! Since it would be hard for the principal to make such an important decision just by looking at your plans, you will need to write a letter. The principal will only chose a plan which follows all of the rules. In the letter you will explain the steps you took to plan your garden and prove to the principal that you followed all of the rules. Let's review the rules."   (Reread the rules listed above.)
- Show the students the Teacher Rubric which will be used to assess their responses. Post it somewhere in the classroom where it can be easily seen by all students.
- Students complete Activity C.
- Teacher collects performance task packets and grades them, using Teacher Rubric.

Extension/Follow Up:

1. Have students determine the cost of each of the different kinds of flowers, using a table of flower prices provided by the teacher.
2. Have students design a garden with pathways between the different flower plots.
3. Have students develop a visual representation of their garden, using different colors and geometric shapes to represent the different types of flowers.
4. Have students present their garden to the class using their visual representation.
5. Have students plant an actual garden, using the garden plans they developed. Choose the winning garden by having a class vote, based on presentations by the students.
6. Make tallies and graphs of the types of flowers used.
7. Determine the fractional parts of each garden, based on area used for each flower.
8. Sing songs about gardening, or write your own class song about gardening.
9. Dramatize the process of creating the garden.
10. Create garden collages using geometric shapes, textiles, three dimensional objects, and any other materials desired.
11. Read books and stories about gardening, and compare and contrast with our experiences.
12. Research gardening in the countries being studied in Social Studies.
13. Write a haiku, cinquain, or other type of poem about gardens, or about one of the types of flowers in your garden.
14. Have students pantomime one aspect of planting a garden. Classmates guess what the student is pantomiming.
15. Create a pattern using the different types of flowers. Have each student create his or her own pattern and challenge a partner to continue the pattern. Next, have each student create a new pattern and challenge a partner to duplicate the pattern without looking at it, being guided only by answering "yes" or "no" questions.
16. Have students "rope off" each separate flower area in their garden, and determine the amount of rope needed to complete this task. (Tricky! What about the outside perimeter, which has already been roped off?)

Authors:

Natalie Comens-Ozga
Cross Country Elementary School
Baltimore City, MD

Barbara Strang
W.T. Page Elementary School
Montgomery County, MD

Name_____ **Date**_____

The principal has decided to turn part of the playground into a garden. The third graders have been invited to design the garden, since they are studying plants in Science. The principal has asked you to draw your garden plan on centimeter graph paper so that she can evaluate the plans in order to determine which design to use. When you complete your design you will write a letter to the principal explaining the steps that you have used to design your garden. You must also prove to the principal that your design follows all of the rules required to ensure proper growth and beauty for the flowers.
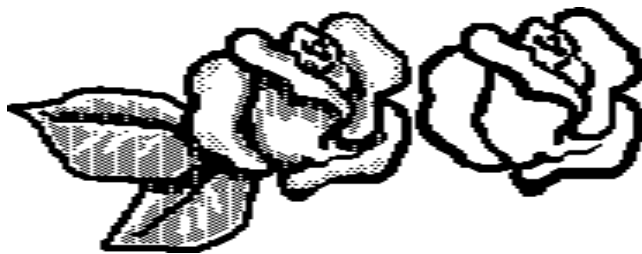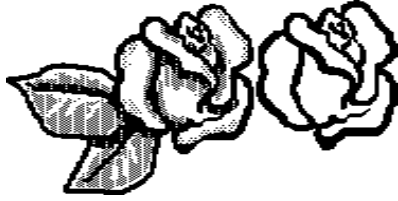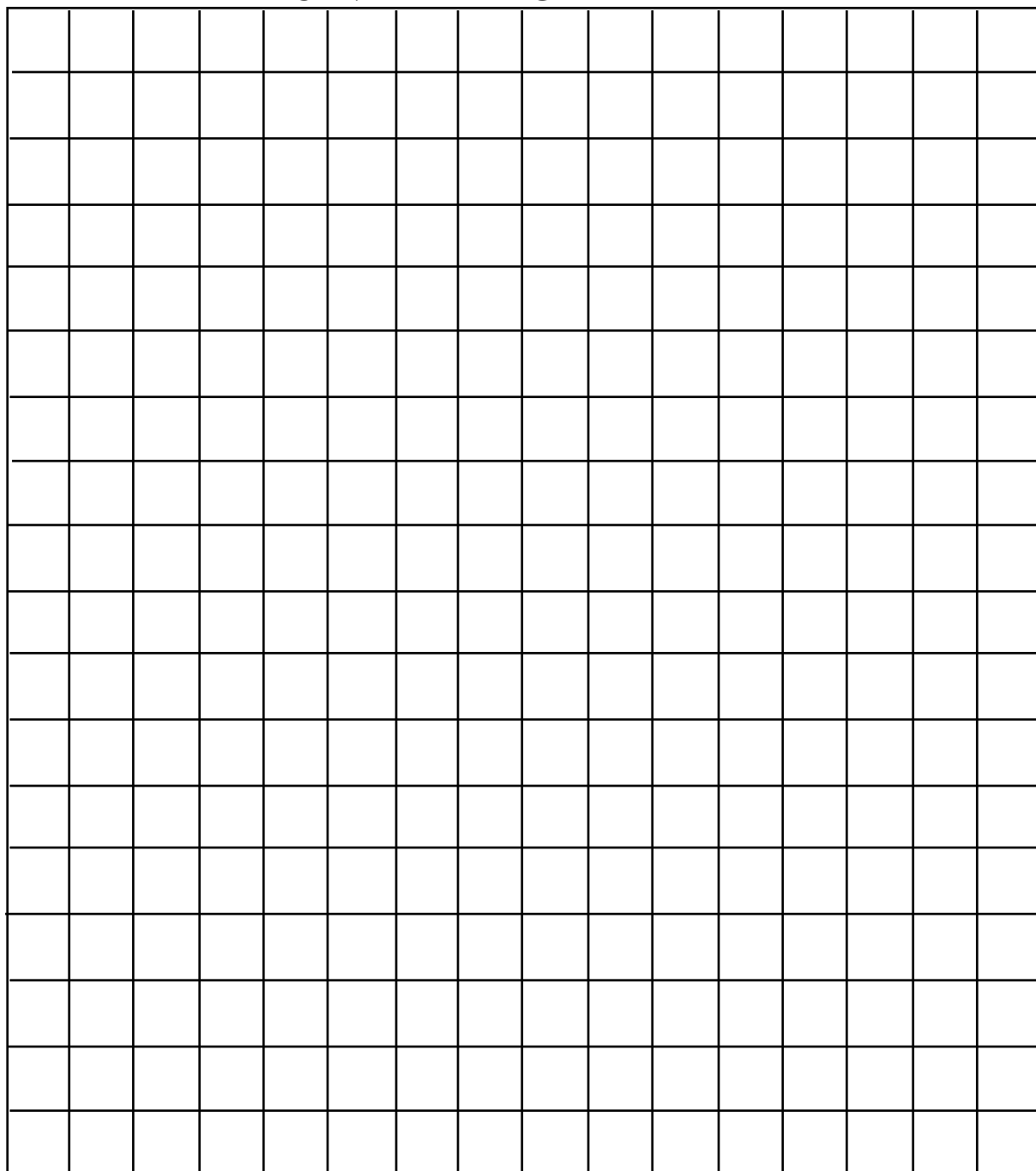
Activity A
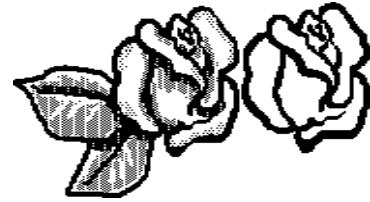
The first thing that we must do is to make sure that the area set aside for the garden is protected. The principal needs to buy a rope to go around the entire perimeter of the garden.   The garden will be six feet wide and nine feet long. Using your centimeter graph paper, draw and label the perimeter of the garden. Notice that the key indicates that one centimeter is equal to one foot.

Calculate how much rope the principal needs to buy in order to rope in the entire garden. Write a number sentence showing how you got your answer.

_____

 Explain how you knew how much rope to buy.

_____

_____

_____

_____

_____

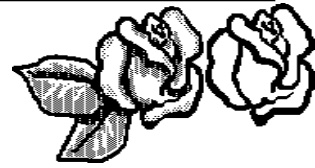# CENTIMETER GRAPH PAPER

KEY: 1 cm. = 1 ft
1 sq. cm. = 1 sq. ft.

Name_____   **Date**_____

My Perimeter Checklist

Check your work in Activity A. Put a check mark on each line if you have completed what the line states. When you have five check marks you have successfully completed Activity A.

_____   **Using the key of 1cm is equal to 1 foot, I drew the measurement around my garden equal to six feet across and nine feet long.**

_____   **I counted the number of units around the outside of my garden to find the perimeter of my garden. If I found the perimeter using another method I used this method to check my work.**

_____   **I used the perimeter of the garden to help me determine how much rope my principal needs to buy.**

_____   **I included appropriate units in my answer.**

_____   **I went back to the steps that I used to find my perimeter in order to write my number sentence.**

_____   **I explained my thinking and the steps that I used to find the perimeter of my garden.**

Activity B

Now you will plan which flowers to plant in the garden. In order to create a garden that looks beautiful and grows well, you must follow these rules in your planning:

- You must use at least three different kinds of flowers.

- You must include at least one sunflower in your garden.

- All of the area in your garden must be used in your plan.

- All sections must be labeled with the name of the flower and shaded in using a different color for each flower. You may use a key to indicate which color stands for each flower.

- Be sure to follow all of the special needs listed in the table.

Now you are ready to begin planning your garden. Remember that one centimeter is equal to one foot on your grid paper. That means that one square centimeter is equal to one square foot on your grid paper.

Maryland Spring Flower Brochure

* Gardeners must use the information in the table below in order to ensure proper growth of your flowers.

Helpful Garden Planning Table

Flower Name	Area Needed Per Plant	Special Needs
Black-eyed Susan	**4 square feet**	**Must be planted in groups of 3**
Marigold	**1 square foot**	**No special needs can be planted anywhere**
Rose	**4 square feet**	**Must be planted in groups of 2**
Daisy	**2 square feet**	**Must be planted in groups of 4**
Sunflower	**6 square feet**	**No special needs can be planted anywhere**

Activity C
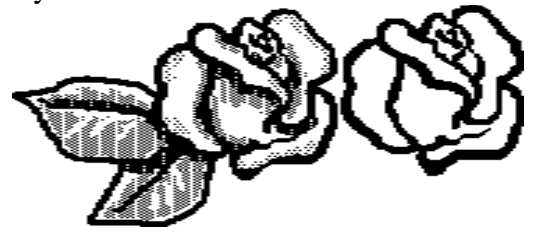
Now that you have designed such beautiful gardens, we are ready to submit your designs to the principal! Since it would be hard for the principal to make such an important decision just by looking at your plans, you will need to write a letter. The principal will only chose a plan which follows all of the rules. In the letter you will explain the steps you took to plan your garden and prove to the principal that you followed all of the rules. Let's review the rules.

_____

_____

_____

_____

_____

_____

_____

_____

Garden Design Rubric

4
- Garden design meets all criteria stated.
- All plants are labeled properly.
- Number sentence proves that the sum of individual plant areas is equal to the total area of the garden.
- Math reasoning and thinking written in a clear detailed explanation in a logical sequential order to explain procedure.

3
- Garden design meets all criteria stated.
- All plants are labeled properly.
- Number sentence written with correct mathematical thinking but may contain computational errors.
- Math reasoning and thinking explained in a logical sequential order to explain procedure.

2
- Garden meets most of the criteria stated.
- At least some plant areas are labeled
- Number sentence written with correct mathematical thinking but may contain computation errors.
- Math reasoning and thinking explained to explain procedure.

1
- Garden represents the use of area in design but does not meet most of the criteria stated.
- Number sentence does not show any math reasoning to prove that the sum of individual areas used are equal to the total area of the garden.
- Explanation of procedure includes limited math reasoning and thinking.

0
- Garden does not represent any shading of area in design.
- Number sentence not attempted or is unrelated to problem.
- Explanation is not attempted or is unrelated to problem or mathematics.